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| 09/998,519 | 11/27/2001 | Shih-Zheng Kuo | JCLA8198 | 5384 |

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| EXAMINER | |
|---|---|
| THOMPSON, JAMES A | |
| **ART UNIT** | **PAPER NUMBER** |
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| SHORTENED STATUTORY PERIOD OF RESPONSE | MAIL DATE | DELIVERY MODE |
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

| Office Action Summary | Application No. | Applicant(s) |
|---|---|---|
| | 09/998,519 | KUO, SHIH-ZHENG |
| | Examiner | Art Unit |
| | James A. Thompson | 2625 |

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *16 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1-24* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-24* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *27 November 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 16 January 2007 has been entered.

### *Response to Arguments*

2. Applicant's arguments filed 16 January 2007 have been fully considered but they are not persuasive.

The full combination of Boyd (USPN 6,166,831), Scott (USPN 6,928,195 B2), and Ogasawara (USPN 4,409,625) does teach the limitations recited in claim 1, including the limitation that each row of sensors is spaced apart from each other row of sensors. Said limitation was, prior to the present amendment, merely a statement in the preamble of the claim. Said limitation has now been incorporated as part of the body of the claim, and is thus addressed in the prior art rejections below.

Furthermore, the combination of Scott with Boyd does not render the system of Boyd unsatisfactory for its intended purpose since Scott is relied upon for the particular interlacing pattern shown therein. While Scott may require multiple scans of the document, Boyd does not. Boyd generates the particular disclosed scanning pattern based on the arrangement of sensor elements, and not through multiple scan operations. By combining Scott with Boyd, the sensor arrangements of Boyd would be modified so as to generate the interlacing pattern taught by Scott.

Finally, the present amendments to the claims and the newly added claims have been fully considered by Examiner and are addressed below in the prior art rejections.

### *Claim Rejections - 35 USC § 103*

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. **Claims 1-2, 4 and 9-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boyd (US Patent 6,166,831) in view of Scott (US Patent 6,928,195 B2) and Ogasawara (US Patent 4,409,625).**

**Regarding claim 1:** Boyd discloses moving the motor (column 2, lines 44-46 of Boyd) during an exposure time (column 2, lines 52-56 of Boyd) a distance substantially equal to a width of one row of the sensors at a speed substantially equal to the width divided by an exposure time (figure 3 and column 3, lines 16-20 of Boyd). Row **30** is read when signal A (figure 3 (54) of Boyd) is high and row **32** is read when signal B (figure 3(56) of Boyd) is high (column 3. lines 16-20 of Boyd). Moving either the sensor or the paper in a scanner system (column 2, lines 44-46 of Boyd) inherently requires some form of motor. Since sensor reading is performed in equal times for each row (figure 3 of Boyd), then said motor moves at a constant speed. The high signal time of the waveform of either row (figure 3(54, 56) of Boyd) is the exposure time for the associated row. Given the very basic and well-known equation $\{speed\} = \{distance\}/\{time\}$, it is therefore demonstrated that the motor moves a distance equal to a width of one row of the sensors at a speed equal to the width divided by an exposure time. or $\{speed\} = W_1/(t_2 - t_1) = W_2/(t_3 - t_2)$ (figure 3(54,56) and column 3. lines 16-20 of Boyd).

Boyd further discloses using m (m=2) rows of the sensors (figure 2(30,32) of Boyd) to scan m document portions (column 3, lines 1-9 of Boyd) during the exposure time (column 3, lines 16-20 of Boyd). By staggering the image signals of two rows (column 3, lines 7-12 of Boyd). the resolution is doubled (column 3, lines 11-15 of Boyd).

Boyd does not disclose expressly that said m rows are used *concurrently* to scan: that each of said m document portions are not adjacent to any other of said m document portions; and that each row of sensors is spaced apart from each other row of sensors.

Scott discloses scanning m document portions (the individual portions of figure 4(420) of Scott). wherein each of said m document portions are not adjacent to any other of said m document portions

(figure 4(410); and column 4, lines 44-45 and lines 49-52 of Scott). Each nutating position that is scanned (figure 4(402-408) of Scott) is interlaced with each other to produce a higher-resolution image (column 4, lines 44-52 of Scott). The individual document portions scanned for each nutating position are therefore not adjacent to any other document portions in said nutating position.

Boyd and Scott are combinable because they are from the same field of endeavor, namely increasing the resolution of scanned digital image data by staggering the scanning positions. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the interlacing pattern taught by Scott instead of simply staggering the pixels, as taught by Boyd. The motivation for doing so would have been that the interlacing procedure taught by Scott allows for a greater level of resolution increase (column 4, lines 40-44 of Scott). Therefore, it would have been obvious to combine Scott with Boyd.

Boyd in view of Scott does not disclose expressly that said m rows are used *concurrently* to scan; and that each row of sensors is spaced apart from each other row of sensors.

Ogasawara discloses scanning a plurality of lines of an original document concurrently (figure 3 and column 2, lines 42-49 of Ogasawara). Each line is scanned by an individual sensor ($9_1$-$9_5$) of the set of sensors (column 2, lines 42-49 of Ogasawara).

Ogasawara further discloses that each row of sensors is spaced apart from each other row of sensors (figure 3 and column 2, lines 42-58 of Ogasawara). Each element ($9_1$-$9_5$) can itself be considered an individual sensor. Each sensor ($9_1$-$9_5$) reads an individual line of document data (column 2, lines 42-58 of Ogasawara). As can be seen from figure 3 of Ogasawara, each sensor is spaced apart from each other sensor.

Boyd in view of Scott is combinable with Ogasawara because they are from the same field of endeavor, namely digital document scanning and digital processing of the resultant digital image. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to scan a plurality of lines concurrently, each with a corresponding individual sensor element, as taught by Ogasawara, each of said individual sensor elements respectively corresponding to each of said m rows of sensors taught by Boyd since each element taught by Ogasawara scans an individual line. The motivation for doing so would have been to be able to skip lines that do not contain non-blank image information (column 2, lines 49-52 of Ogasawara), thus providing greater speed of scanning and data acquisition (column 1, lines 62-68 of Ogasawara). Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to space sensor elements on each row (such as $9_1$-$9_5$) apart from each other, as taught by Ogasawara. In Boyd, this would result in the rows of sensor elements being spaced apart from

each other. Additionally, Boyd shows sensor rows offset from one another (figure 2 of Boyd), but the diagram is merely illustrative. The individual sensors (figure 2(35) of Boyd) have positions of centroids of sensitivity (column 3, lines 1-5 of Boyd) which are themselves shown to be separate. So, the actual sensing is performed in the system taught by Boyd at positions which are separate from one another. Thus, physically separating the sensor elements merely requires that the elements be fitted so that they do not touch, but maintain the same positions of centroids of sensitivity. Therefore, the similarities between the optical properties of the system of Boyd and the physical properties of the system of Ogasawara would have suggested to one of ordinary skill in the art at the time of the invention to space the sensor rows of Boyd apart from one another, *as per* the teachings of Ogasawara. Therefore, it would have been obvious to combine Ogasawara with Boyd in view of Scott to obtain the invention as specified in claim 1.

**Regarding claim 4:** Boyd discloses processing and re-sorting a plurality of staggered image signals to obtain a plurality of image data (figure 5(60,62,64) and column 4, lines 7-15 of Boyd).

**Regarding claims 9 and 19:** Boyd discloses means for allowing a scanner to have a scan resolution thereof increased m times (column 3, lines 11-15 of Boyd), wherein the scanner comprises a motor (column 2, lines 44-46 of Boyd) and a charge coupled device (column 1, lines 11-12 and column 2, lines 42-44 of Boyd), wherein the charge coupled device comprises m rows of sensors spaced a distance from each other (figure 1(18) and column 2, lines 47-52 of Boyd).

Boyd further discloses that the means for allowing a scanner to have a scan resolution increase of m times comprises means for moving the motor (column 2, lines 44-46 of Boyd) during an exposure time (column 2, lines 52-56 of Boyd) a distance substantially equal to a width of one row of the sensors at a speed substantially equal to the width divided by an exposure time (figure 3 and column 3, lines 16-20 of Boyd). Row **30** is read when signal A (figure 3(54) of Boyd) is high and row **32** is read when signal B (figure 3(56) of Boyd) is high (column 3, lines 16-20 of Boyd). Moving either the sensor or the paper in a scanner system (column 2, lines 44-46 of Boyd) inherently requires some form of motor. Since sensor reading is performed in equal times for each row (figure 3 of Boyd), then said motor moves at a constant speed. The high signal time of the waveform of either row (figure 3(54,56) of Boyd) is the exposure time for the associated row. Given the very basic and well-known equation $\{speed\} = \{distance\}/\{time\}$, it is therefore demonstrated that the motor moves a distance equal to a width of one row of the sensors at a speed equal to the width divided by an exposure time, or $\{speed\} = W_1/(t_2 - t_1) = W_2/(t_3 - t_2)$ (figure 3 (54,56) and column 3, lines 16-20 of Boyd).

Boyd further discloses that the means for allowing a scanner to have a scan resolution increase of m times further includes means for using m (m=2) rows of the sensors (figure 2 (30,32) of Boyd) to scan

m document portions (column 3, lines 1-9 of Boyd) during the exposure time (column 3, lines 16-20 of Boyd). By staggering the image signals of two rows (column 3, lines 7-12 of Boyd), the resolution is doubled (column 3, lines 11-15 of Boyd).

Boyd does not disclose expressly that said m rows are used *concurrently* to scan; and that each of said m document portions are not adjacent to any other of said m document portions.

Scott discloses scanning m document portions (the individual portions of figure 4(420) of Scott), wherein each of said m document portions are not adjacent to any other of said m document portions (figure 4(410); and column 4, lines 44-45 and lines 49-52 of Scott). Each nutating position that is scanned (figure 4(402-408) of Scott) is interlaced with each other to produce a higher-resolution image (column 4, lines 44-52 of Scott). The individual document portions scanned for each nutating position are therefore not adjacent to any other document portions in said nutating position.

Boyd and Scott are combinable because they are from the same field of endeavor, namely increasing the resolution of scanned digital image data by staggering the scanning positions. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the interlacing pattern taught by Scott instead of simply staggering the pixels, as taught by Boyd. The motivation for doing so would have been that the interlacing procedure taught by Scott allows for a greater level of resolution increase (column 4, lines 40-44 of Scott). Therefore, it would have been obvious to combine Scott with Boyd.

Boyd in view of Scott does not disclose expressly that said m rows are used *concurrently* to scan.

Ogasawara discloses scanning a plurality of lines of an original document concurrently (figure 3 and column 2, lines 42-49 of Ogasawara). Each line is scanned by an individual element ($9_1$-$9_5$) of the sensor (column 2, lines 42-49 of Ogasawara).

Boyd in view of Scott is combinable with Ogasawara because they are from the same field of endeavor, namely digital document scanning and digital processing of the resultant digital image. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to scan a plurality of lines concurrently, each with a corresponding individual sensor element, as taught by Ogasawara, each of said individual sensor elements respectively corresponding to each of said m rows of sensors taught by Boyd since each element taught by Ogasawara scans an individual line. The motivation for doing so would have been to be able to skip lines that do not contain non-blank image information (column 2, lines 49-52 of Ogasawara), thus providing greater speed of scanning and data acquisition (column 1, lines 62-68 of Ogasawara). Therefore, it would have been obvious to combine Ogasawara with Boyd in view of Scott to obtain the invention as specified in claims 9 and 19.

Further regarding claim 19: The apparatus of claim 19 is wholly embodied by the apparatus of claim 9.

**Regarding claims 2, 10 and 20:** Boyd discloses that the distance between rows of sensors is substantially equal to $(x/m)+n$ times of the width, wherein x is a positive integer smaller than m, and n is an integer equal to or larger than 0 (column 3, lines 9-15 of Boyd). In the system taught by Boyd, the resolution is increased by a factor of two (column 3, lines 11-15 of Boyd) for two rows (column 3, lines 7-10 of Boyd), and thus m is equal to 2, the spacing distance is one half (column 3, lines 9-12 of Boyd), and thus x is equal to one, which is a positive integer smaller than m. Further, due to the compact staggering of the sensors (figure 2(30,32) of Boyd), n is an integer equal to 0.

**Regarding claims 11 and 13:** Boyd discloses means for scanning a first portion and a second portion of a document using a first row of sensors for the first document portion and a second row of sensors for the second document portion (figure 2(30,32) and column 3, lines 1-9 of Boyd); means for scanning a third portion and a fourth portion of a document using the first row of sensors for the third document portion and the second row of sensors for the fourth document portion (figure 2(30,32) and column 3, lines 1-9 of Boyd); and means for storing data from the first and second rows of sensors to produce image data (column 4, lines 8-13 of Boyd). Since only two rows are read at once using two rows of sensors (figure 2(30,32) and column 3, lines 1-9 of Boyd), the third and fourth document portions will be read by the first and second rows of sensors, respectively, after said first and second rows of sensors have finished reading the first and second document portions, respectively.

Boyd does not disclose expressly that said scanning of a first portion and a second portion of a document is performed concurrently; that the first and second document portions are not adjacent to each other; that the first and second row of sensors are spaced apart from each other; that said scanning of a third portion and a fourth portion of a document is performed concurrently; and that the third and fourth document portions are not adjacent to each other.

Scott discloses scanning m document portions (the individual portions of figure 4(420) of Scott), wherein each of said m document portions are not adjacent to any other of said m document portions (figure 4(410); and column 4, lines 44-45 and lines 49-52 of Scott). Each nutating position that is scanned (figure 4(402-408) of Scott) is interlaced with each other to produce a higher-resolution image (column 4, lines 44-52 of Scott). The individual document portions scanned for each nutating position are therefore not adjacent to any other document portions in said nutating position.

Boyd and Scott are combinable because they are from the same field of endeavor, namely increasing the resolution of scanned digital image data by staggering the scanning positions. At the time

of the invention, it would have been obvious to a person of ordinary skill in the art to use the interlacing pattern taught by Scott instead of simply staggering the pixels, as taught by Boyd. By interlacing according to the teachings of Scott, the first and second document portions are not adjacent to each other and the third and fourth document portions are not immediately adjacent to each other. The motivation for doing so would have been that the interlacing pattern taught by Scott allows for a greater level of resolution increase (column 4, lines 40-44 of Scott). Therefore, it would have been obvious to combine Scott with Boyd.

Scott in view of Boyd does not disclose expressly that said scanning of a first portion and a second portion of a document is performed concurrently; that the first and second row of sensors are spaced apart from each other; and that said scanning of a third portion and a fourth portion of a document is performed concurrently.

Ogasawara discloses scanning a plurality of lines of an original document concurrently (figure 3 and column 2, lines 42-49 of Ogasawara); and that each row of sensors is spaced apart from each other row of sensors (figure 3 and column 2, lines 42-58 of Ogasawara). Each element ($9_1$-$9_5$) can itself be considered an individual sensor. Each sensor ($9_1$-$9_5$) reads an individual line of document data (column 2, lines 42-58 of Ogasawara). As can be seen from figure 3 of Ogasawara, each sensor is spaced apart from each other sensor.

Boyd in view of Scott is combinable with Ogasawara because they are from the same field of endeavor, namely digital document scanning and digital processing of the resultant digital image. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to scan a plurality of lines concurrently, each with a corresponding individual sensor element, as taught by Ogasawara, each of said individual sensor elements respectively corresponding to each of said m rows of sensors taught by Boyd since each element taught by Ogasawara scans an individual line. Thus, said scanning of a first portion and a second portion of a document is performed concurrently; and said scanning of the third portion and the fourth portion of a document is performed concurrently. The motivation for doing so would have been to be able to skip lines that do not contain non-blank image information (column 2, lines 49-52 of Ogasawara), thus providing greater speed of scanning and data acquisition (column 1, lines 62-68 of Ogasawara). Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to space sensor elements on each row (such as $9_1$-$9_5$) apart from each other, as taught by Ogasawara. In Boyd, this would result in the rows of sensor elements being spaced apart from each other. Additionally, Boyd shows sensor rows offset from one another (figure 2 of Boyd), but the diagram is merely illustrative. The individual sensors (figure 2(35) of Boyd) have positions of centroids

of sensitivity (column 3, lines 1-5 of Boyd) which are themselves shown to be separate. So, the actual sensing is performed in the system taught by Boyd at positions which are separate from one another. Thus, physically separating the sensor elements merely requires that the elements be fitted so that they do not touch, but maintain the same positions of centroids of sensitivity. Therefore, the similarities between the optical properties of the system of Boyd and the physical properties of the system of Ogasawara would have suggested to one of ordinary skill in the art at the time of the invention to space the sensor rows of Boyd apart from one another, *as per* the teachings of Ogasawara. Therefore, it would have been obvious to combine Ogasawara with Boyd in view of Scott to obtain the invention as specified in claims 11 and 13.

Further regarding claim 11: The apparatus of claim 13 performs the method of claim 11.

**Regarding claims 12 and 14:** Boyd discloses that the first and second rows of sensors are spaced apart from each other at least a distance of one quarter of the width of each of the rows of sensors (figure 4(30b,32b) and column 2, lines 57-64 of Boyd).

**Regarding claims 15 and 17:** Boyd discloses means for dividing a scanning area in to a plurality of scanning regions (column 2, lines 57-62 of Boyd); means for scanning (column 2, lines 44-52 of Boyd) a first portion of a first of the plurality of scanning regions (figure 4(30b) of Boyd) using a first array of sensors (figure 3(30) of Boyd) during a first time period (column 2, lines 52-59 of Boyd); means for scanning (column 2, lines 44-52 of Boyd) a second portion of said first of the plurality of scanning regions (figure 4(32b) of Boyd) using a second array of sensors (figure 3(32) of Boyd) during a second time period (column 2, lines 52-59 of Boyd); and means for scanning (column 2, lines 44-52 of Boyd) a portion of a second of the plurality of scanning regions using the first array of sensors during a third time period (column 2, lines 52-59 of Boyd). As the paper progresses, the first array of sensors will read another of the plurality of scanning regions after the second array of sensors is finished reading a previous one of the plurality of scanning regions.

Boyd does not disclose expressly that said portion of another of the plurality of scanning regions is scanned by said first array of sensors during the second time period; that the first and second of the plurality of scanning regions are not adjacent to each other; and that the first and second arrays of sensors are spaced apart from each other.

Scott discloses scanning a first and a second of a plurality of scanning regions (the individual portions of figure 4(420) of Scott), wherein said first and second of the plurality of scanning regions are not adjacent to each other (figure 4 (410); and column 4, lines 44-45 and lines 49-52 of Scott). Each nutating position that is scanned (figure 4(402-408) of Scott) is interlaced with each other to produce a

higher-resolution image (column 4, lines 44-52 of Scott). The individual document port-ions scanned for each nutating position are therefore not adjacent to any other document portions in said nutating position.

Boyd and Scott are combinable because they are from the same field of endeavor, namely increasing the resolution of scanned digital image data by staggering the scanning positions. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the interlacing pattern taught by Scott instead of simply staggering the pixels, as taught by Boyd. By interlacing according to the teachings of Scott, the first and second of the plurality of scanning regions are not adjacent to each other. The motivation for doing so would have been that the interlacing pattern taught by Scott allows for a greater level of resolution increase (column 4, lines 40-44 of Scott). Therefore, it would have been obvious to combine Scott with Boyd.

Boyd in view of Scott does not disclose expressly that said portion of another of the plurality of scanning regions is scanned by said first array of sensors during the second time period; and that the first and second arrays of sensors are spaced apart from each other.

Ogasawara discloses dividing a scanning area in to a plurality of scanning regions (figure 3($L_1 \ldots L_5$) and column 2, lines 44-49 of Ogasawara); and scanning a plurality of scanning regions of an original document concurrently (figure 3 and column 2, lines 42-49 of Ogasawara). Each line is scanned by an individual element ($9_1$-$9_5$) of the sensor (column 2, lines 42-49 of Ogasawara).

Ogasawara further discloses that each row of sensors is spaced apart from each other row of sensors (figure 3 and column 2, lines 42-58 of Ogasawara). Each element ($9_1$-$9_5$) can itself be considered an individual sensor. Each sensor ($9_1$-$9_5$) reads an individual line of document data (column 2, lines 42-58 of Ogasawara). As can be seen from figure 3 of Ogasawara, each sensor is spaced apart from each other sensor.

Boyd in view of Scott is combinable with Ogasawara because they are from the same field of endeavor, namely digital document scanning and digital processing of the resultant digital image. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to scan a plurality of scanning regions concurrently, each with a corresponding individual sensor element, as taught by Ogasawara. Thus, the first array of sensors taught by Boyd would read during the second time period, along with the second array of sensors. The motivation for doing so would have been to be able to skip lines that do not contain non-blank image information (column 2, lines 49-52 of Ogasawara), thus providing greater speed of scanning and data acquisition (column 1, lines 62-68 of Ogasawara). Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to space sensor elements on each row (such as $9_1$-$9_5$) apart from each other, as taught by Ogasawara.

In Boyd, this would result in the rows of sensor elements being spaced apart from each other. Additionally, Boyd shows sensor rows offset from one another (figure 2 of Boyd), but the diagram is merely illustrative. The individual sensors (figure 2(35) of Boyd) have positions of centroids of sensitivity (column 3, lines 1-5 of Boyd) which are themselves shown to be separate. So, the actual sensing is performed in the system taught by Boyd at positions which are separate from one another. Thus, physically separating the sensor elements merely requires that the elements be fitted so that they do not touch, but maintain the same positions of centroids of sensitivity. Therefore, the similarities between the optical properties of the system of Boyd and the physical properties of the system of Ogasawara would have suggested to one of ordinary skill in the art at the time of the invention to space the sensor rows of Boyd apart from one another, *as per* the teachings of Ogasawara. Therefore, it would have been obvious to combine Ogasawara with Boyd in view of Scott to obtain the invention as specified in claims 15 and 17.

Further regarding claim 15: The apparatus of claim 17 performs the method of claim 15.

**Regarding claims 16 and 18:** Boyd discloses means for sorting data from the first and second arrays of sensors to assemble image data (figure 5(60,62,64) and column 4, lines 7-15 of Boyd).

**Regarding claim 21:** Boyd discloses a circuit (figure 5 of Boyd) adapted to sort a plurality of staggered image signals from the m rows of sensors (figure 5(60,62,64) and column 4, lines 7-15 of Boyd).

**5. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boyd (US Patent 6,166,831) in view of Scott (US Patent 6,928,195 B2), Ogasawara (US Patent 4,409,625), and Teeter (US Patent 4,451,030).**

**Regarding claim 3:** Boyd in view of Scott and Ogasawara does not disclose expressly that the motor comprises a step motor.

Teeter discloses a scanner with sensing elements which are driven by a step motor (figure 3(84) and column 3, lines 49-51 of Teeter).

Boyd in view of Scott and Ogasawara is combinable with Teeter because they are from similar problem solving areas, namely the mechanical control of sensing elements in a digital scanner. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use a step motor, as taught by Teeter, in the scanner taught by Boyd in view of Scott and Ogasawara. The suggestion for doing so would have been that a step motor is a useful type of motor to control with stepped electrical driving pulses (column 4, lines 46-51 of Teeter), such as also taught by Boyd (figure 3

of Boyd). Therefore, it would have been obvious to combine Teeter with Boyd in view of Scott and Ogasawara to obtain the invention as specified in claim 3.

6. **Claims 5-6, 8 and 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Boyd (US Patent 6,166,831) in view of Scott (US Patent 6,928,195 B2), Ogasawara (US Patent 4,409,625), and Shimizu (US Patent 5,777,308).**

**Regarding claims 5 and 22:** Boyd discloses a motor (column 2, lines 44-46 of Boyd); and a charge coupled device (column 1, lines 11-12 and column 2, lines 42-44 of Boyd) comprising m rows of sensors spaced a distance from each other (figure 1(18) and column 2, lines 47-52 of Boyd), wherein the motor is adapted to move (column 2, lines 44-46 of Boyd) during an exposure time (column 2, lines 52-56 of Boyd) a distance substantially equal to a width of one row of the sensors at a speed equal to the width divided by an exposure time (figure 3 and column 3, lines 16-20 of Boyd). Row **30** is read when signal A (figure 3(54) of Boyd) is high and row **32** is read when signal B (figure 3(56) of Boyd) is high (column 3, lines 16-20 of Boyd). Moving either the sensor or the paper in a scanner system (column 2, lines 44-46 of Boyd) inherently requires some form of motor. Since sensor reading is performed in equal times for each row (figure 3 of Boyd), then said motor moves at a constant speed. The high signal time of the waveform of either row (figure 3(54,56) of Boyd) is the exposure time for the associated row. Given the very basic and well-known equation $\{speed\} = \{distance\}/\{time\}$, it is therefore demonstrated that the motor moves a distance equal to a width of one row of the sensors at a speed equal to the width divided by an exposure time, or $\{speed\} = W_1/(t_2 - t_1) = W_2/(t_3 - t_2)$ (figure 3(54,56) and column 3, lines 16-20 of Boyd).

Boyd further discloses that $(m+1)$ rows of the sensors (figure 2(30,32) of Boyd) are adapted to scan m document portions (column 3, lines 1-9 of Boyd) during the exposure time (column 3, lines 16-20 of Boyd), for a resolution increase of $(m+1)$ (column 3, lines 11-15 of Boyd $(m=1)$). By staggering the image signals of two rows (column 3, lines 7-12 of Boyd), the resolution is doubled (column 3, lines 11-15 of Boyd).

Boyd does not disclose expressly moving the motor a distance substantially equal to $m/(m+1)$ times the width of one row of the sensors at a speed substantially equal to $m/(m+1)$ times the width divided by the exposure time; using m rows of sensors (for a resolution enhancement of $(m+1)$) to *concurrently* scan during the exposure time; that each of said m document portions are not adjacent to any

other of said m document portions; and that each row of sensors is spaced apart from each other row of sensors.

Scott discloses scanning m document portions (the individual portions of figure 4(420) of Scott), wherein each of said m document portions are not adjacent to any other of said m document portions (figure 4(410); and column 4, lines 44-45 and lines 49-52 of Scott). Each nutating position that is scanned (figure 4(402-408) of Scott) is interlaced with each other to produce a higher-resolution image (column 4, lines 44-52 of Scott). The individual document portions scanned for each nutating position are therefore not adjacent to any other document portions in said nutating position.

Boyd and Scott are combinable because they are from the same field of endeavor, namely increasing the resolution of scanned digital image data by staggering the scanning positions. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to use the interlacing pattern taught by Scott instead of simply staggering the pixels, as taught by Boyd. The motivation for doing so would have been that the interlacing pattern taught by Scott allows for a greater level of resolution increase (column 4, lines 40-44 of Scott). Therefore, it would have been obvious to combine Scott with Boyd.

Boyd in view of Scott does not disclose expressly moving the motor a distance substantially equal to $m/(m+1)$ times the width of one row of the sensors at a speed substantially equal to $m/(m+1)$ times the width divided by the exposure time; using m rows of sensors (for a resolution enhancement of $(m+1)$) to *concurrently* scan during the exposure time; and that each row of sensors is spaced apart from each other row of sensors.

Ogasawara discloses scanning a plurality of lines of an original document simultaneously (figure 3 and column 2, lines 42-49 of Ogasawara). Each line is scanned by an individual element ($9_1$-$9_5$) of the sensor (column 2, lines 42-49 of Ogasawara).

Ogasawara further discloses that each row of sensors is spaced apart from each other row of sensors (figure 3 and column 2, lines 42-58 of Ogasawara). Each element ($9_1$-$9_5$) can itself be considered an individual sensor. Each sensor ($9_1$-$9_5$) reads an individual line of document data (column 2, lines 42-58 of Ogasawara). As can be seen from figure 3 of Ogasawara, each sensor is spaced apart from each other sensor.

Boyd in view of Scott is combinable with Ogasawara because they are from the same field of endeavor, namely digital document scanning and digital processing of the resultant digital image. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to scan a plurality of lines simultaneously, each with a corresponding individual sensor element, as taught by Ogasawara,

each of said individual sensor elements respectively corresponding to each of said $(m+1)$ rows of sensors taught by Boyd since each element taught by Ogasawara scans an individual line. The motivation for doing so would have been to be able to skip lines that do not contain non-blank image information (column 2, lines 49-52 of Ogasawara), thus providing greater speed of scanning and data acquisition (column 1, lines 62-68 of Ogasawara). Furthermore, at the time of the invention, it would have been obvious to a person of ordinary skill in the art to space sensor elements on each row (such as $9_1$-$9_5$) apart from each other, as taught by Ogasawara. In Boyd, this would result in the rows of sensor elements being spaced apart from each other. Additionally, Boyd shows sensor rows offset from one another (figure 2 of Boyd), but the diagram is merely illustrative. The individual sensors (figure 2(35) of Boyd) have positions of centroids of sensitivity (column 3, lines 1-5 of Boyd) which are themselves shown to be separate. So, the actual sensing is performed in the system taught by Boyd at positions which are separate from one another. Thus, physically separating the sensor elements merely requires that the elements be fitted so that they do not touch, but maintain the same positions of centroids of sensitivity. Therefore, the similarities between the optical properties of the system of Boyd and the physical properties of the system of Ogasawara would have suggested to one of ordinary skill in the art at the time of the invention to space the sensor rows of Boyd apart from one another, *as per* the teachings of Ogasawara. Therefore, it would have been obvious to combine Ogasawara with Boyd in view of Scott.

Boyd in view of Scott and Ogasawara does not disclose expressly moving the motor a distance substantially equal to $m/(m+1)$ times the width of one row of the sensors at a speed substantially equal to $m/(m+1)$ times the width divided by the exposure time; and using m rows of sensors (for a resolution enhancement of $(m+1)$) to concurrently scan (as taught by Ogasawara) during the exposure time.

Shimizu discloses increasing the resolution of a scanner (column 3, lines 9-16 of Shimizu) by sampling at a particular angle (figure 3(42) and column 5, lines 26-28 and lines 39-45 of Shimizu).

Boyd in view of Scott and Ogasawara is combinable with Shimizu because they are from similar problem solving areas, namely the enhancement of scanner resolution. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to apply various different angles to increase scanner resolution, as taught by Shimizu, than the 45° angle between rows used for staggering in the system taught by Boyd in view of Ogasawara. Thus for a general case of a system taught by Boyd in view of Scott, Ogasawara and Shimizu, m rows of sensors would be used to scan during the exposure time, thus obtaining a resolution enhancement of $(m+1)$ for certain specified angles. Further, in a general case of a system taught by Boyd in view of Scott, Ogasawara and Shimizu, the motor would

therefore move a distance equal to $m/(m+1)$ times the width of one row of the sensors. Since, as has been demonstrated above in the system of Boyd in view of Scott and Ogasawara, the motor moves the sensors at a constant rate during the exposure time, the motor would therefore move a distance equal to $m/(m+1)$ times the width of one row of the sensors at a speed substantially equal to $m/(m+1)$ times the width divided by the exposure time. The suggestion for doing so would have been that the system taught by Shimizu achieves through angled sampling a resolution smaller than a single pixel (column 3, lines 9-15 of Shimizu), which is also the goal of the system taught by Boyd (column 3, lines 11-15 of Boyd). Therefore, it would have been obvious to combine Shimizu with Boyd in view of Scott and Ogasawara to obtain the invention as specified in claims 5 and 22.

Further regarding claim 5: The apparatus of claim 22 performs the method of claim 5.

**Further regarding claims 6 and 23:** For a particularly selected angle for staggering, such as 45° ( $\tan^{-1}(1/1)$ ) or 33.69° ( $\tan^{-1}(2/3)$ ), using the system taught by Boyd in view of Scott, Ogasawara and Shimizu as discussed above in the arguments regarding claim 5, the spacing distance between the rows of sensors will be equal to n times the width, wherein n is an integer equal to or larger than 0.

**Regarding claim 8:** Boyd discloses processing and re-sorting a plurality of staggered image signals to obtain a plurality of image data (figure 5(60,62,64) and column 4, lines 7-15 of Boyd).

**Regarding claim 24:** Boyd discloses a circuit (figure 5 of Boyd) adapted to sort a plurality of staggered image signals from the m rows of sensors (figure 5(60,62,64) and column 4, lines 7-15 of Boyd).

7. **Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Boyd (US Patent 6,166,831) in view of Scott (US Patent 6,928,195 B2), Ogasawara (US Patent 4,409,625), Shimizu (US Patent 5,777,308), and Teeter (US Patent 4,451,030).**

**Regarding claim 7:** Boyd in view of Scott, Ogasawara and Shimizu does not disclose expressly that the motor comprises a step motor.

Teeter discloses a scanner with sensing elements which are driven by a step motor (figure 3(84) and column 3, lines 49-51 of Teeter).

Boyd in view of Scott, Ogasawara and Shimizu is combinable with Teeter because they are from similar problem solving areas, namely the mechanical control of sensing elements in a digital scanner. At the time of the invention, it would have been obvious to a person of ordinary skill in the art to specifically use a step motor, as taught by Teeter, in the scanner taught by Boyd in view of Scott, Ogasawara and Shimizu. The suggestion for doing so would have been that a step motor is a useful type of motor to

control with stepped electrical driving pulses (column 4, lines 46-51 of Teeter), such as also taught by Boyd (figure 3 of Boyd). Therefore, it would have been obvious to combine Teeter with Boyd in view of Scott, Ogasawara and Shimizu to obtain the invention as specified in claim 7.

*Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James A. Thompson whose telephone number is 571-272-7441. The examiner can normally be reached on 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David K. Moore can be reached on 571-272-7437. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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